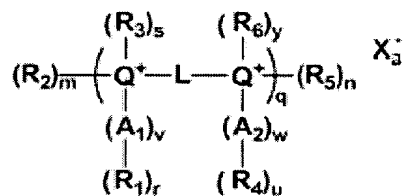


What Is Claimed Is:

1. A compound having the formula:



5 wherein

Q is selected from the group consisting of N, O and S;

L is C, CH, (CH₂)_i, or {(CH₂)_i - Y - (CH₂)_j}_k, wherein Y is selected from the group consisting of CH₂, an ether, a polyether, an amide, a polyamide, an ester, a sulfide, an urea, a thiourea, a guanidyl, a carbamoyl, a carbonate, a phosphate, a sulfate, a sulfoxide, an imine, a carbonyl, and a secondary amino group and wherein Y is optionally substituted by -X₁- L' - X₂- Z or - Z;

R₁ - R₆, independently of one another, are selected from the group consisting of H, - (CH₂)_p-D-Z, an alkyl, an alkenyl, an aryl, and an alkyl or alkyl ether optionally substituted by one or more of an alcohol, an aminoalcohol, an amine, an amide, an ether, a polyether, a polyamide, an ester, a mercaptan, an alkylthio, a urea, a thiourea, a guanidyl, or a carbamoyl group, and wherein at least one of R₁, R₃, R₄ and R₆ is a straight chain or branched, cyclic, alkyl, alkenyl, alkynyl or aryl group having from about 6 to about 64 carbon atoms; and R₁ and R₄ or R₃ and R₆ may optionally be covalently linked with each other, with Y or with L when L is C or CH to form a cyclic moiety;

Z is selected from the group consisting of amine, spermiyl, carboxyspermiyl, guanidyl, spermidinyl, putricinyl, diaminoalkyl, pyridyl, piperidinyl, pyrrolidinyl, polyamine, amino acid, peptide, and protein;

X₁ and X₂ independently of one another, are selected from the group consisting of NH, O, S, alkylene, and arylene;

L' is selected from the group consisting of alkyl, alkenylene, alkynylene, arylene, alkylene ether, and polyether;

D is Q or a bond;

A₁ and A₂ independently of one another, are selected from the group consisting of CH₂O, CH₂S, CH₂NH, C(O), C(NH), C(S) and (CH₂)_t;

X is a physiologically acceptable anion;

m, n, r, s, u, v, w and y are 0 or 1, with the proviso that when both m and n are 0 at least one of r, s, u and y is other than 0;

i, j, k, l, p and t are integers from 0 to about 100;

q is an integer from 1 to about 1000; and

5 a is the number of positive charge divided by the valence of the anion.

2. The compound as claimed in claim 1, wherein at least one of R₁, R₃, R₄ and R₆ is a straight chain or branched, cyclic, alkyl, alkenyl, alkynyl or aryl having from about 8 to about 24 carbon atoms.

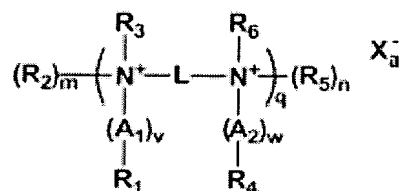
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3. The compound as claimed in claim 1, wherein the alkyl ether optionally substituted by one or more alcohol groups comprises a carbohydrate.

4. The compound as claimed in claim 3, wherein the carbohydrate is selected from the group consisting of galactose, fructose, glucose, maltose, sucrose, cellobiose, lactose, mannose, glucopyranose, mannopyranose and galactopyranose.

15

5. The compound as claimed in claim 1, wherein said compound has the formula:



20 wherein

L is (CH₂)_l or {(CH₂)_i - Y - (CH₂)_j}_k wherein Y is selected from the group consisting of CH₂ an ether, a polyether, an amide, a polyamide, an ester, a sulfide, a urea, a thiourea, a guanidyl, a carbamoyl, a carbonate, and a secondary amino group;

R₁ - R₆, independently of one another, are selected from the group consisting of H, - (CH₂)_p-Z, an alkyl, an alkenyl, an aryl, and an alkyl or alkyl ether optionally substituted by one or more of an alcohol, an aminoalcohol, an amine, an amide, an ether, a polyether, a polyamide, an ester, a mercaptan, a urea, a thiourea, a guanidyl, or a carbamoyl group, and at least one of R₁, R₃, R₄ and R₆ is a straight chain or branched, cyclic, alkyl, alkenyl, alkynyl or aryl group having from about 6 to about 64 carbon atoms; and R₁ and R₄ or R₃ and R₆ may

25

30 optionally be covalently linked with each other to form a cyclic moiety;

Z is selected from the group consisting of amine, spermiyl, carboxyspermiyl, guanidyl, spermidinyl, putricinyl, diaminoalkyl, pyridyl, piperidinyl, pyrrolidinyl, polyamine, amino acid, peptide, and protein;

A₁ and A₂ independently of one another, are selected from the group consisting of CH₂O, CH₂S, CH₂NH, C(O), C(NH), C(S) and (CH₂)_t;

X is a physiologically acceptable anion;

m, n, v and w are 0 or 1;

i, j, k, l, p and t are integers from 1 to about 100;

q is an integer from 1 to about 1000; and

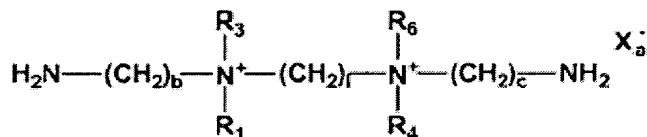
a is the number of positive charge divided by the valence of the anion, wherein when m and n are 0, then a is 0.

6. The compound as claimed in claim 5, wherein at least one of R₁, R₃, R₄ and R₆ is a straight chain or branched, cyclic, alkyl, alkenyl, alkynyl or aryl having from about 8 to about 24 carbon atoms.

7. The compound as claimed in claim 5, wherein the alkyl ether optionally substituted by one or more alcohol groups comprises a carbohydrate.

8. The compound as claimed in claim 7, wherein the carbohydrate is selected from the group consisting of galactose, fructose, glucose, maltose, sucrose, cellobiose, lactose, mannose, glucopyranose, mannopyranose and galactopyranose.

9. The compound as claimed in claim 5, wherein said compound has the formula:



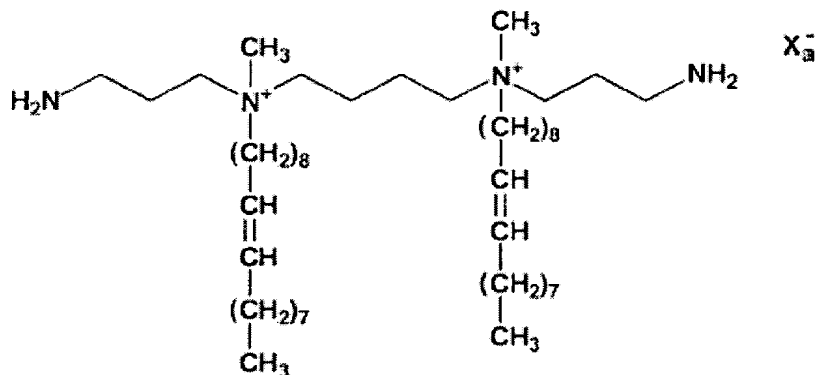
wherein

R₁, R₃, R₄ and R₆, independently of one another, are selected from the group consisting of H and a C₁-C₈ alkyl, alkenyl, aryl, and alkyl optionally substituted by one or more of an alcohol, an amine, an amide, an ether, a polyether, a polyamide, an ester, a mercaptan, a urea, a thiourea, a guanidyl, or a carbamoyl group, and at least one of R₁, R₃, R₄

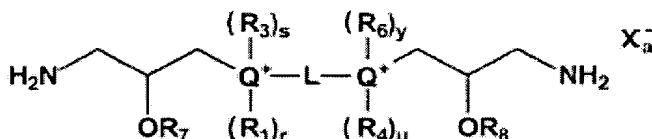
and R₆ is a straight chain or branched, cyclic, alkyl, alkenyl, alkynyl or aryl group having from about 8 to about 24 carbon atoms; and

l, b and c are integers independently selected from 1 to about 4.

- 5 10. The compound as claimed in claim 9, which is:



11. The compound as claimed in claim 1, wherein said compound has the formula:



10

wherein

Q and L are as defined in claim 1;

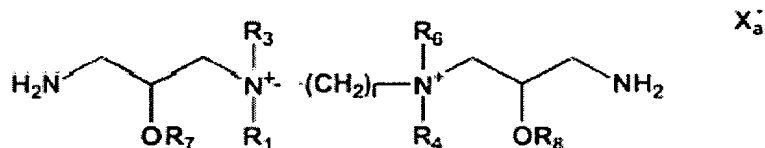
- 15 R₁, R₃, R₄ and R₆, independently of one another, are selected from the group consisting of H and a C₁-C₈ alkyl, alkenyl, aryl, and alkyl optionally substituted by one or more of an alcohol, an amine, an amide, an ether, a polyether, a polyamide, an ester, a mercaptan, a urea, a thiourea, a guanidyl, or a carbamoyl group;

r, s, u and y are 0 or 1; and

R₇ and R₈ are independently H or a carbohydrate.

20

12. The compound as claimed in claim 11, wherein said compound has the formula:



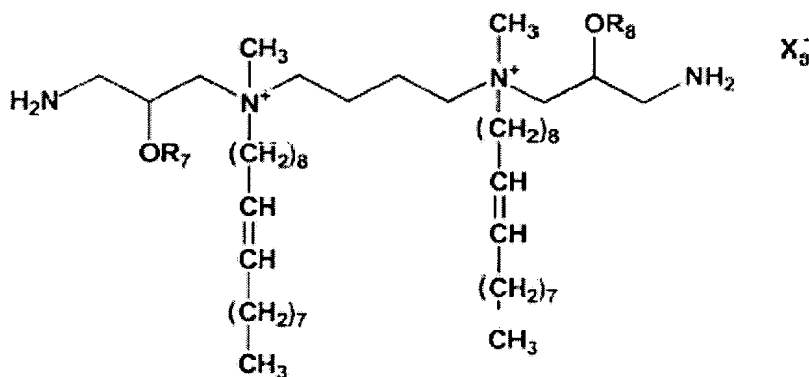
wherein

R₁, R₃, R₄ and R₆, independently of one another, are selected from the group consisting of H and a C₁-C₈ alkyl, alkenyl, aryl, and alkyl optionally substituted by one or more of an alcohol, an amine, an amide, an ether, a polyether, a polyamide, an ester, a mercaptan, a urea, a thiourea, a guanidyl, or a carbamoyl group, and at least one of R₁, R₃, R₄ and R₆ is a straight chain or branched, cyclic, alkyl, alkenyl, alkenyl or aryl group having from about 8 to about 24 carbon atoms;

R₇ and R₈ are independently H or a carbohydrate; and

l is an integer from 1 to about 4.

13. The compound as claimed in claim 12, which is:

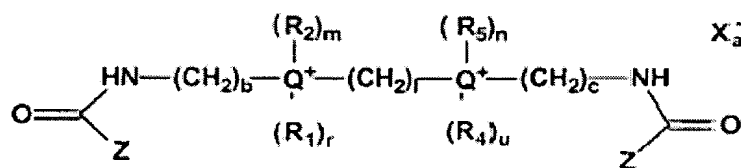


wherein

R₇ and R₈ are independently H or a carbohydrate.

14. The compound as claimed in claim 13, wherein R₇ and R₈ are H.

15. The compound as claimed in claim 1, wherein said compound has the formula:



wherein

Q is as defined in claim 1;

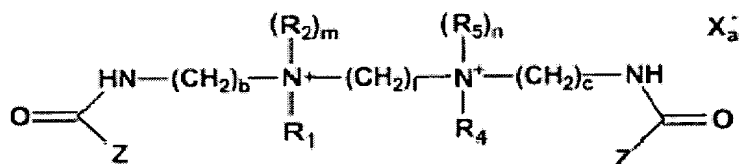
R₁, R₃, R₄ and R₅, independently of one another, are selected from the group consisting of H and a C₁-C₈ alkyl, alkenyl, aryl, and alkyl optionally substituted by one or more of an alcohol, an amine, an amide, an ether, a polyether, a polyamide, an ester, a mercaptan, a urea, a thiourea, a guanidyl, or a carbamoyl group;

Z is selected from the group consisting of spermyl, spermidyl, amino acid, peptidyl, diaminoalkyl, and polyamine;

m, n, r and u are 0 or 1; and

l, b and c are integers independently selected from 1 to about 4.

16. The compound as claimed in claim 5, wherein said compound has the formula:



wherein

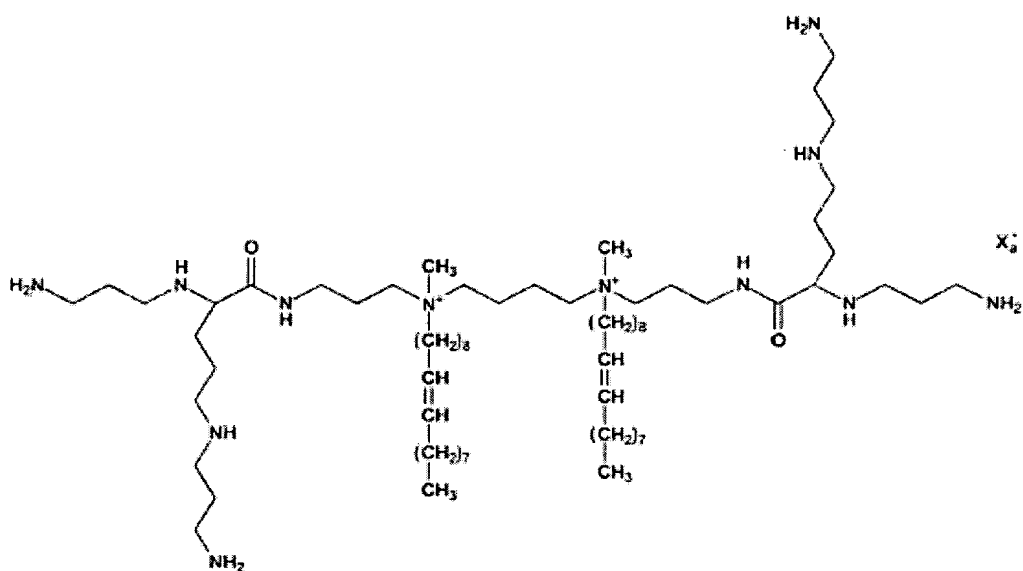
R₁, R₃, R₄ and R₅, independently of one another, are selected from the group consisting of H and a C₁-C₈ alkyl, alkenyl, aryl, and alkyl optionally substituted by one or more of an alcohol, an amine, an amide, an ether, a polyether, a polyamide, an ester, a mercaptan, a urea, a thiourea, a guanidyl, or a carbamoyl group, and at least one of R₁, R₃, R₄ and R₅ is a straight chain or branched, cyclic, alkyl, alkenyl, alkynyl or aryl group having from about 8 to about 24 carbon atoms;

Z is selected from the group consisting of spermyl, spermidyl, amino acid, peptidyl, diaminoalkyl, and polyamine;

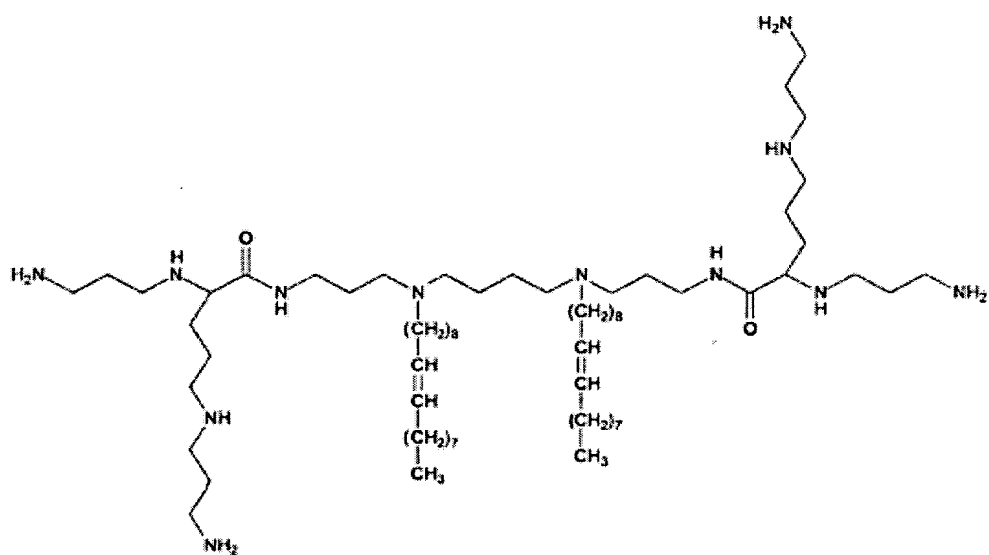
m and n are 0 or 1; and

l, b and c are integers independently selected from 1 to about 4.

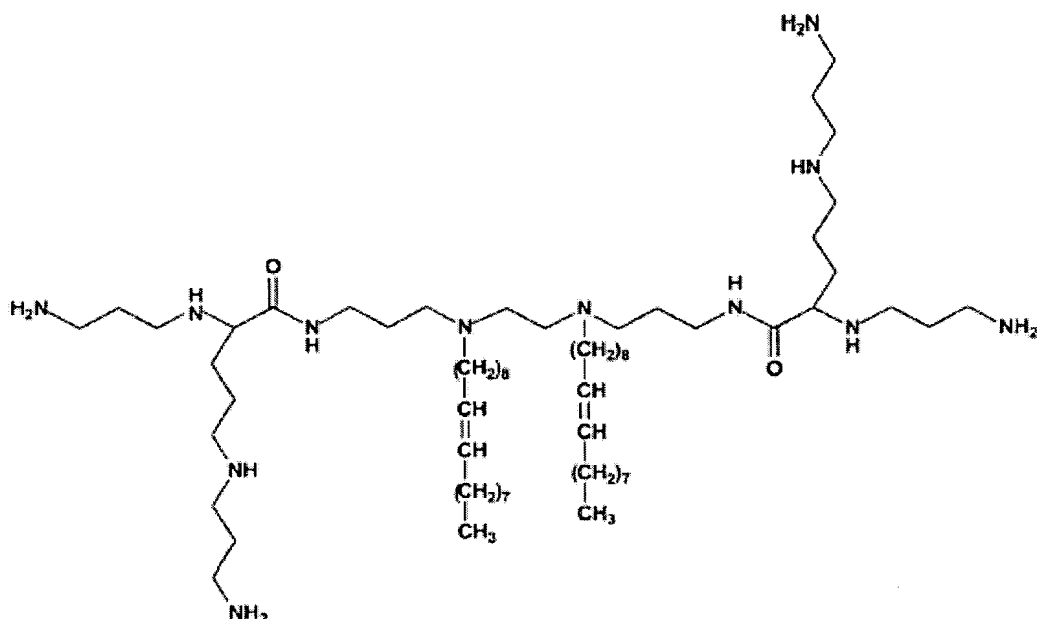
17. The compound as claimed in claim 16, which is:



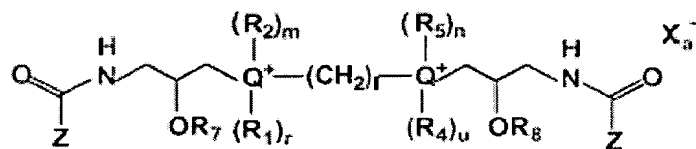
5 18. The compound as claimed in claim 16, which is:



19. The compound as claimed in claim 16, which is:



20. The compound as claimed in claim 1, wherein said compound has the formula:



wherein

5 Q, R₁, R₄, m, n, r and u are as defined in claim 1;

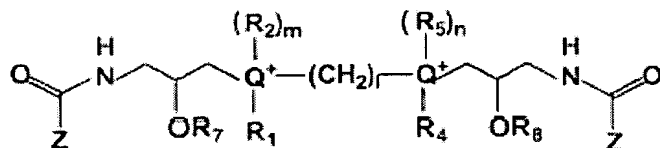
R₂ and R₅ independently of one another, are selected from the group consisting of H and a C₁-C₈ alkyl, alkenyl, aryl, and alkyl optionally substituted by one or more of an alcohol, an amine, an amide, an ether, a polyether, a polyamide, an ester, a mercaptan, a urea, a thiourea, a guanidyl, or a carbamoyl group;

10 Z is selected from the group consisting of spermyl, spermidyl, amino acid, peptidyl, diaminoalkyl, and polyamine;

R₇ and R₈ are independently H or a carbohydrate; and

l is an integer from 1 to about 4.

15 21. The compound as claimed in claim 20, wherein said compound has the formula:



wherein

Q as defined in claim 1;

at least one of R₁ and R₄ is a straight chain or branched, cyclic, alkyl, alkenyl,

5 alkynyl or aryl group having from about 8 to about 24 carbon atoms;

R₂ and R₅, independently of one another, are selected from the group consisting of H and a C₁-C₈ alkyl, alkenyl, aryl, and alkyl optionally substituted by one or more of an alcohol, an amine, an amide, an ether, a polyether, a polyamide, an ester, a mercaptan, a urea, a thiourea, a guanidyl, or a carbamoyl group;

10 Z is selected from the group consisting of spermyl, spermidyl, amino acid, peptidyl, diaminoalkyl, and polyamine;

R₇ and R₈ are independently H or a carbohydrate;

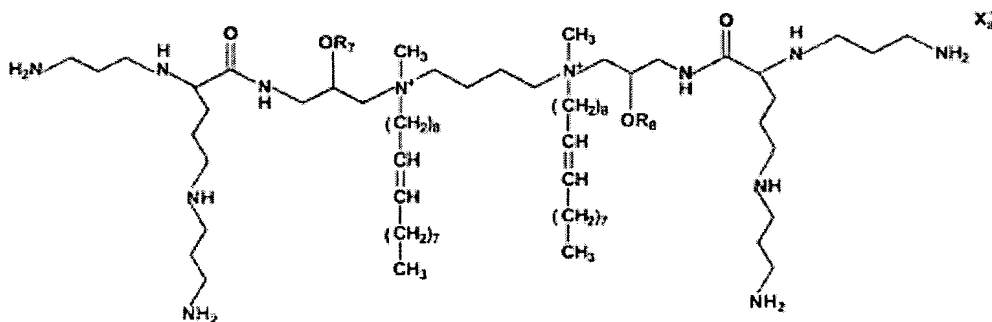
m and n are as defined in claim 1; and

l is an integer from 1 to about 4.

15

22. The compound as claimed in claim 21, wherein Q is N and R₇ and R₈ are H.

23. The compound as claimed in claim 21 which is:

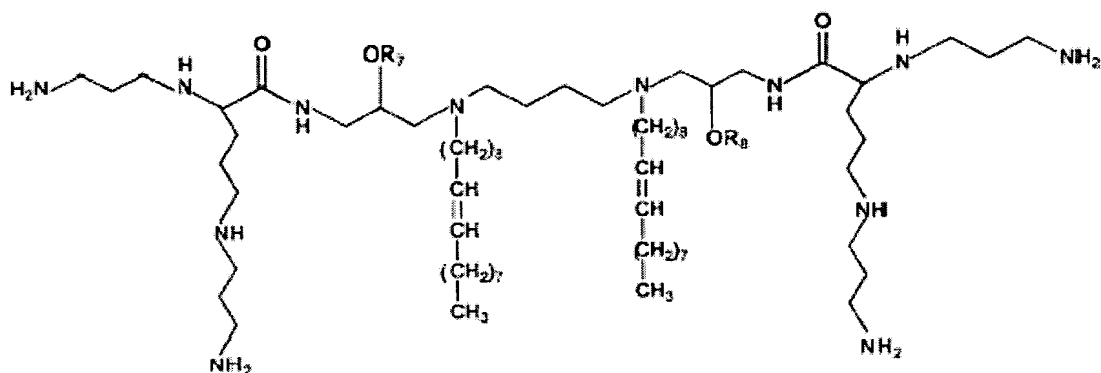


20

wherein R₇ and R₈ are independently H or a carbohydrate.

24. The compound according to claim 23, wherein R₇ and R₈ are H.

25. The compound as claimed in claim 21, which is:

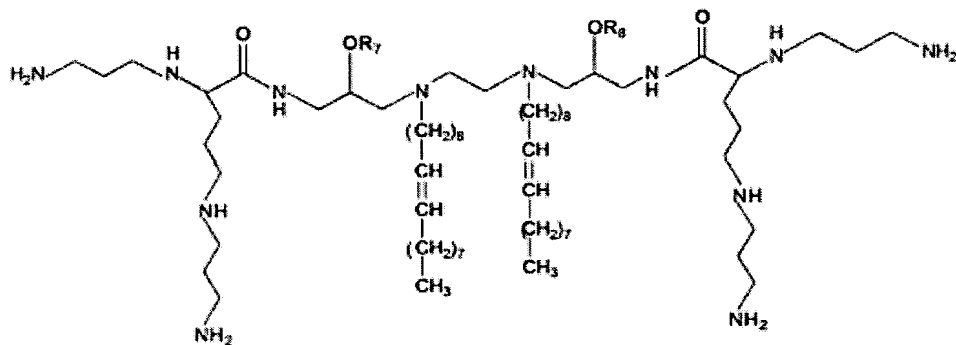


wherein R₇ and R₈ are independently H or a carbohydrate.

5

26. The compound as claimed in claim 25, wherein R₇ and R₈ are H.

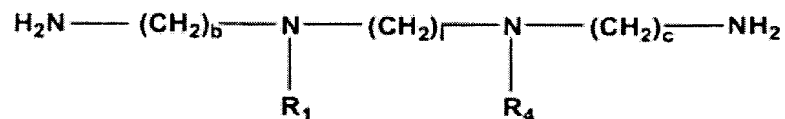
27. The compound as claimed in claim 21, which is:



10 wherein R₇ and R₈ are independently H or a carbohydrate.

28. The compound as claimed in claim 27, wherein R₇ and R₈ are H.

29. The compound as claimed in claim 5, wherein said compound has the formula:

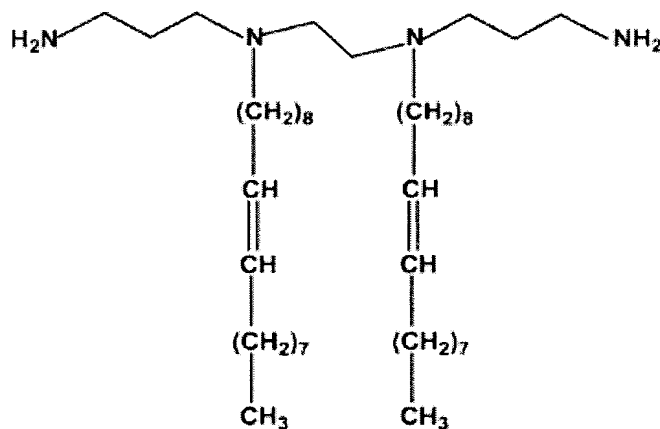


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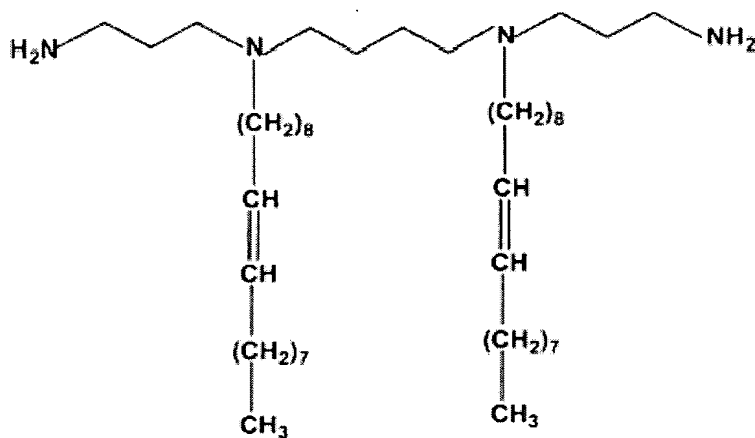
wherein

at least one of R_1 and R_4 is a straight chain or branched, cyclic, alkyl, alkenyl, alkynyl or aryl group having from about 8 to about 24 carbon atoms; and
 l , b and c are integers independently selected from 1 to about 4.

- 5 30. The compound as claimed in claim 29, which is:

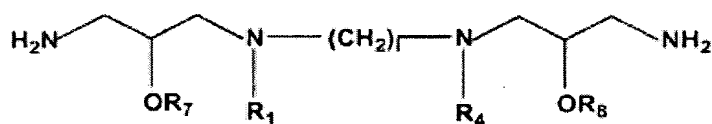


31. The compound as claimed in claim 29, which is:



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32. The compound as claimed in claim 5, wherein said compound has the formula:



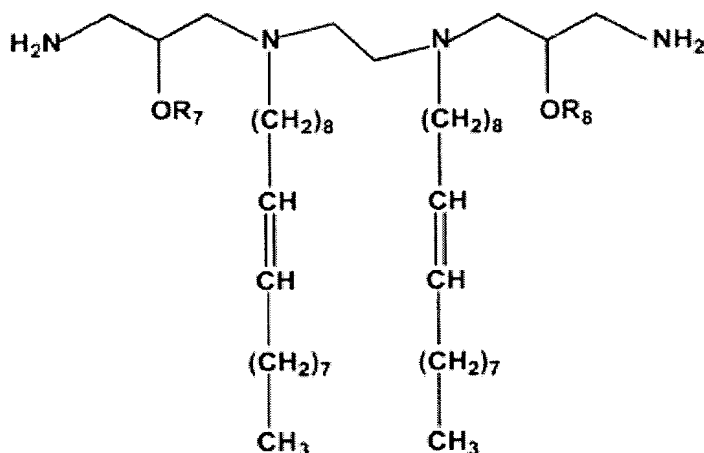
wherein

at least one of R₁ and R₄ is a straight chain or branched, cyclic, alkyl, alkenyl, alkynyl or aryl group having from about 8 to about 24 carbon atoms; R₇ and R₈ are independently hydrogen or a carbohydrate; and

l is an integer from 1 to about 4.

5

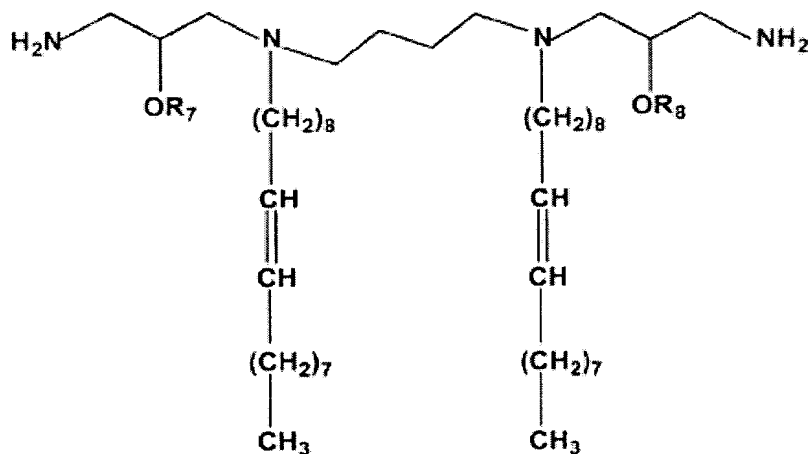
33. The compound as claimed in claim 32, which is:



wherein R₇ and R₈ are independently H or a carbohydrate.

10 34. The compound as claimed in claim 33, wherein R₇ and R₈ are H.

35. The compound as claimed in claim 32, which is:

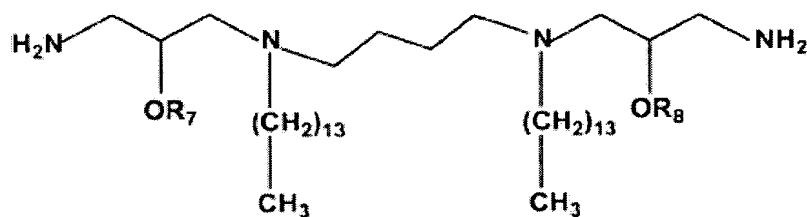


wherein R₇ and R₈ are independently H or a carbohydrate.

15

36. The compound as claimed in claim 35, wherein R₇ and R₈ are H.

37. The compound as claimed in claim 32, which is:

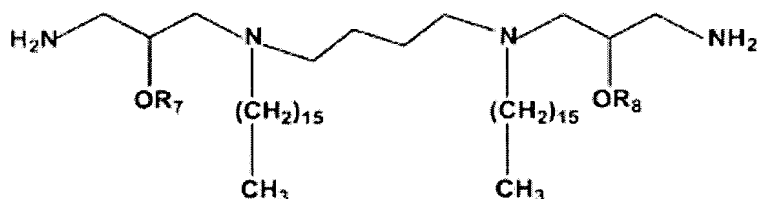


wherein R_7 and R_8 , independently are H or a carbohydrate.

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38. The compound as claimed in claim 37, wherein R_7 and R_8 are H.

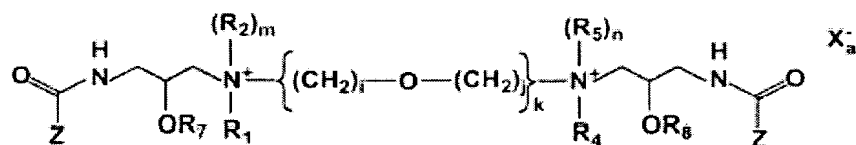
39. The compound as claimed in claim 32, which is:



10 wherein R_7 and R_8 are H or a carbohydrate.

40. The compound as claimed in claim 39, wherein R_7 and R_8 are H.

41. The compound as claimed in claim 5, wherein said compound has the formula:



15

wherein

Z is as defined in claim 5;

at least one of R_1 and R_4 is a straight chain or branched, cyclic, alkyl, alkenyl, alkynyl or aryl group having from about 8 to about 24 carbon atoms;

20

R_2 and R_5 , independently of one another, are selected from the group consisting of H and a C_1 - C_8 alkyl, alkenyl, aryl, and alkyl optionally substituted by one or more of an alcohol,

an amine, an amide, an ether, a polyether, a polyamide, an ester, a mercaptan, a urea, a thiourea, a guanidyl, or a carbamoyl group;

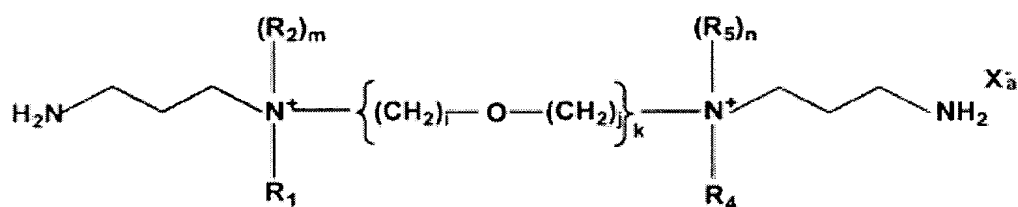
R₇ and R₈ are independently H or a carbohydrate;

m and n are 0 or 1;

5 i and j are integers from about 2 to about 3; and

k is an integer from 1 to about 3.

42. The compound as claimed in claim 5, wherein said compound has the formula:



10

wherein

at least one of R₁ and R₄ is a straight chain or branched, cyclic, alkyl, alkenyl, alkynyl or aryl group having from about 8 to about 24 carbon atoms;

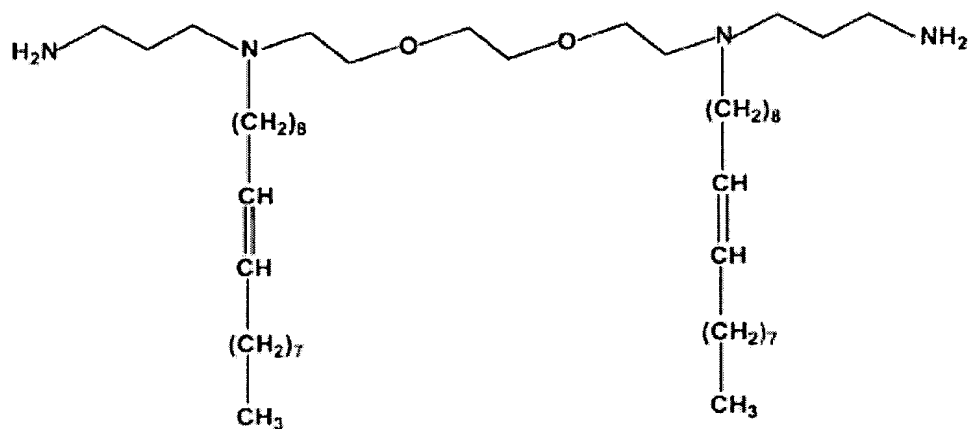
15 R₂ and R₅ independently of one another, are selected from the group consisting of H and a C₁-C₈ alkyl, alkenyl, aryl, and alkyl optionally substituted by one or more of an alcohol, an amine, an amide, an ether, a polyether, a polyamide, an ester, a mercaptan, a urea, a thiourea, a guanidyl, or a carbamoyl group;

m and n are 0 or 1;

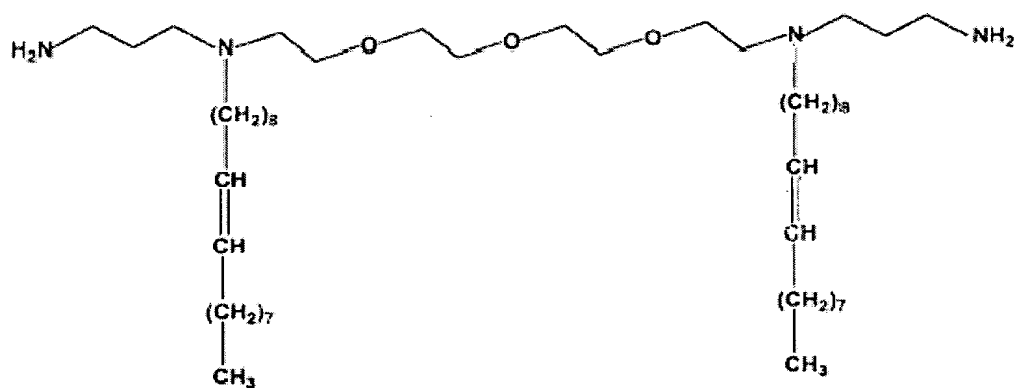
i and j are integers from about 2 to about 3; and

20 k is an integer from 1 to about 3.

43. The compound as claimed in claim 42, which is:

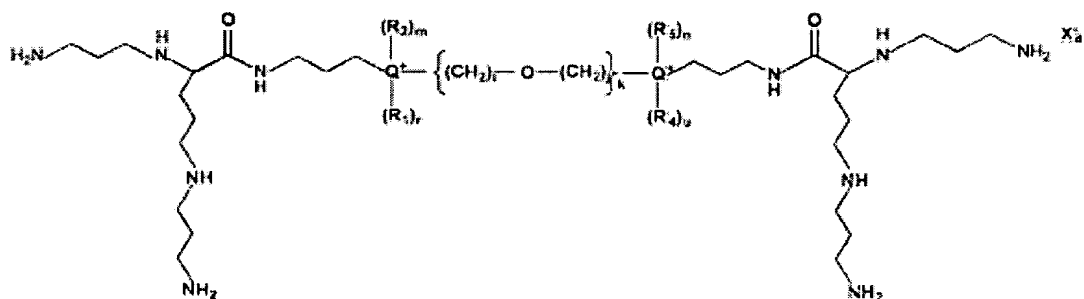


44. The compound as claimed in claim 42, which is:



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45. The compound as claimed in claim 1, wherein said compound has the formula:



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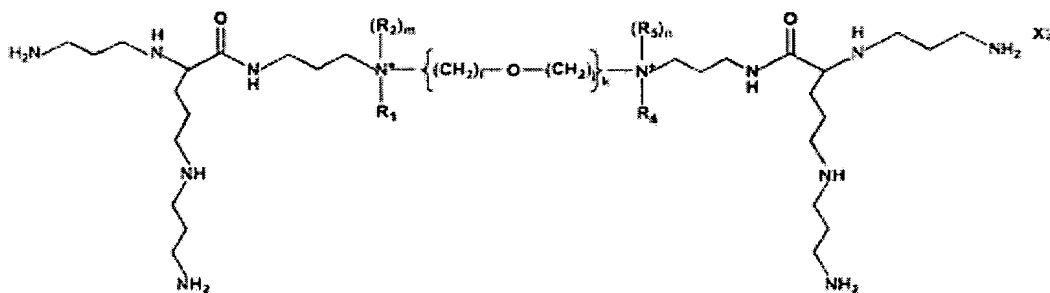
wherein

Q, R₁, R₄, r, u, m and n are as defined in claim 1;

R_2 and R_5 , independently of one another, are selected from the group consisting of H and a C_1 - C_8 alkyl, alkenyl, aryl, and alkyl optionally substituted by one or more of an alcohol, an amine, an amide, an ether, a polyether, a polyamide, an ester, a mercaptan, a urea, a thiourea, a guanidyl, or a carbamoyl group;

- 5 i and j are integers from about 2 to about 3; and
 k is an integer from 1 to about 3.

46. The compound as claimed in claim 5, wherein said compound has the formula:



10 wherein

 at least one of R_1 and R_4 is a straight chain or branched, cyclic, alkyl, alkenyl, alkynyl or aryl group having from about 8 to about 24 carbon atoms;

R_2 and R_5 , independently of one another, are selected from the group consisting of H and a C_1 - C_8 alkyl, alkenyl, aryl, and alkyl optionally substituted by one or more of an alcohol,
 15 an amine, an amide, an ether, a polyether, a polyamide, an ester, a mercaptan, a urea, a thiourea, a guanidyl, or a carbamoyl group;

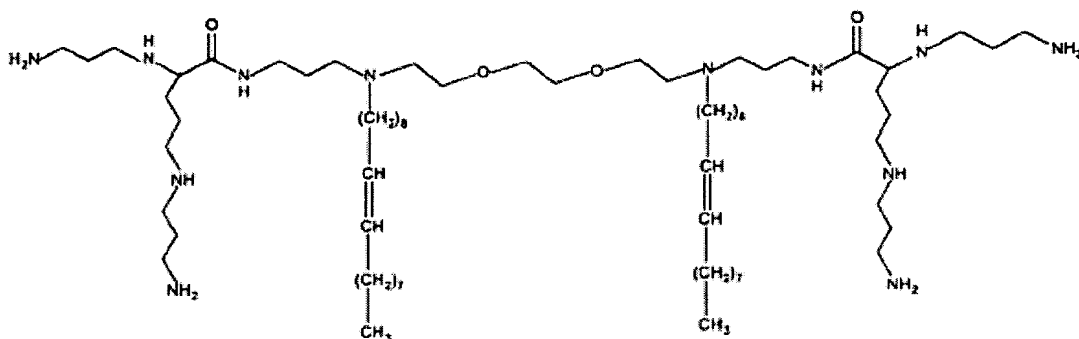
 m and n are 0 or 1;

 i and j are integers from about 2 to about 3; and

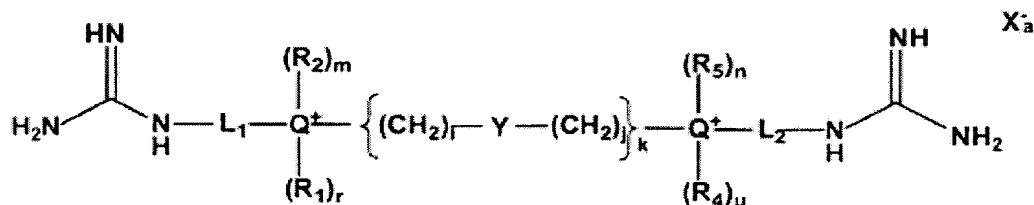
 k is an integer from 1 to about 3.

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47. The compound as claimed in claim 46, which is:



5 48. The compound as claimed in claim 1, wherein said compound has the formula:



wherein

Q, R₁, R₄, r, u, m and n are as defined in claim 1;

10 R₂ and R₅ independently of one another, are selected from the group consisting of H and a C₁ – C₈ alkyl, alkenyl, aryl, and alkyl optionally substituted by one or more of an alcohol, an amine, an amide, an ether, a polyether, a polyamide, an ester, a mercaptan, a urea, a thiourea, a guanidyl, or a carbamoyl group;

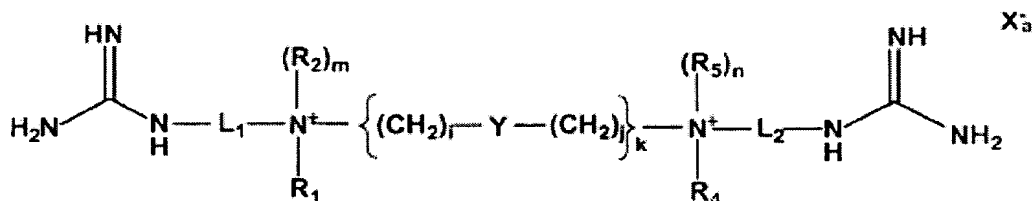
i and j are integers from about 2 to about 3;

k is an integer from 1 to about 3;

15 L₁ and L₂, independently from one another, are an alkylene or an alkylene ether; and

Y is selected from the group consisting of CH₂, O, S and NH.

49. The compound as claimed in claim 5, wherein said compound has the formula:



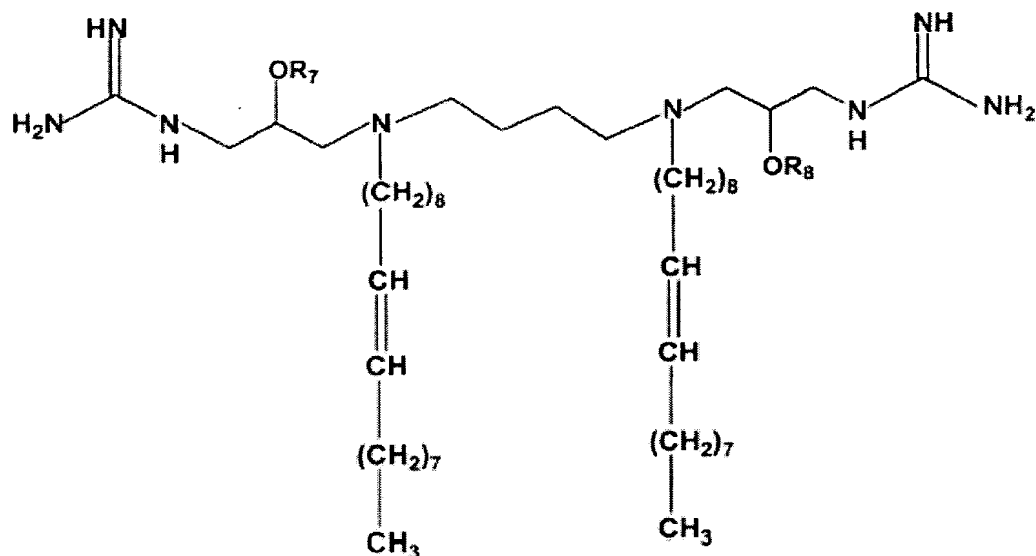
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NC(=N)NCCCCN(CCCCCC/C=C/CCCC)CCCCN(CCCCCC/C=C/CCCC)CCCCNC(=N)N

15

51. The compound as claimed in claim 49, which is:

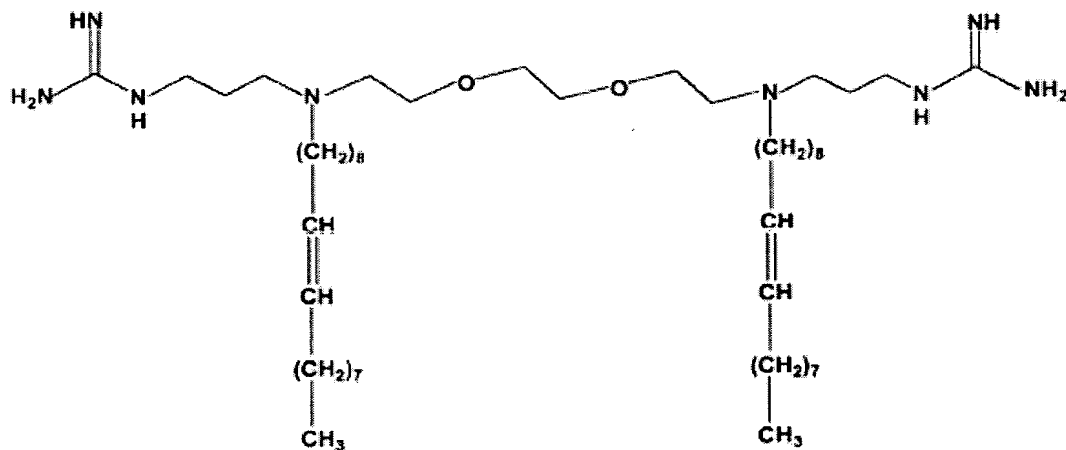


wherein R₇ and R₈ are independently H or a carbohydrate.

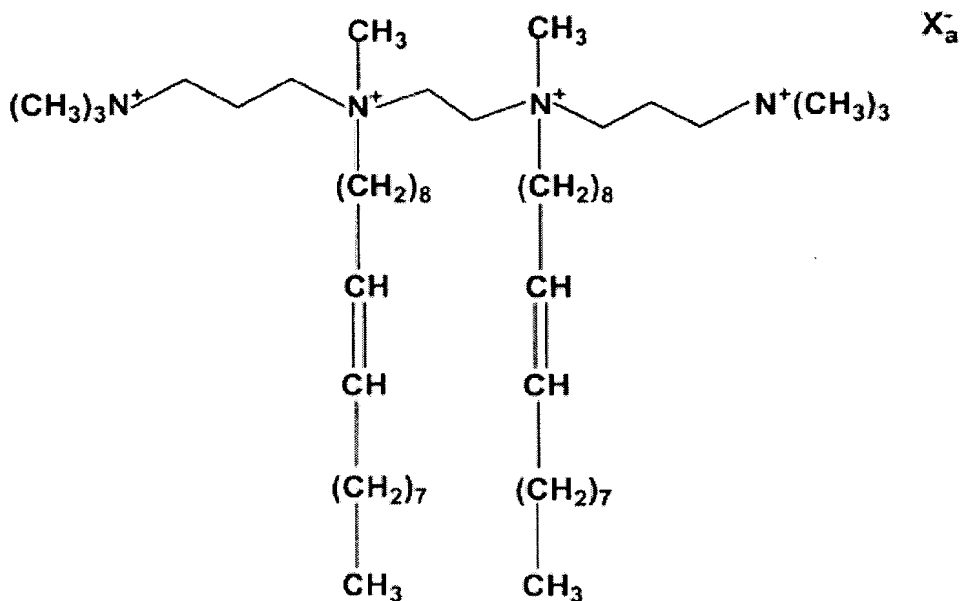
52. The compound as claimed in claim 51, wherein R₇ and R₈ are H.

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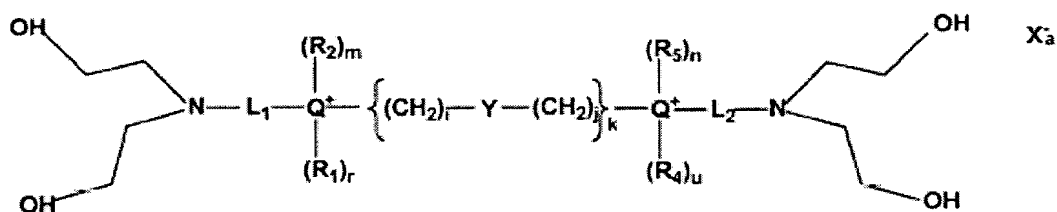
53. The compound as claimed in claim 49, which is:



10 54. The compound as claimed in claim 5, which is:



55. The compound as claimed in claim 1, wherein said compound has the formula:



wherein

Q, R₁, R₄, r, u, m and n are as defined in claim 1;

R₂ and R₅, independently of one another, are selected from the group consisting of H and a C₁ – C₈ alkyl, alkenyl, aryl, and alkyl optionally substituted by one or more of an alcohol, an amine, an amide, an ether, a polyether, a polyamide, an ester, a mercaptan, a urea, a thiourea, a guanidyl, or a carbamoyl group;

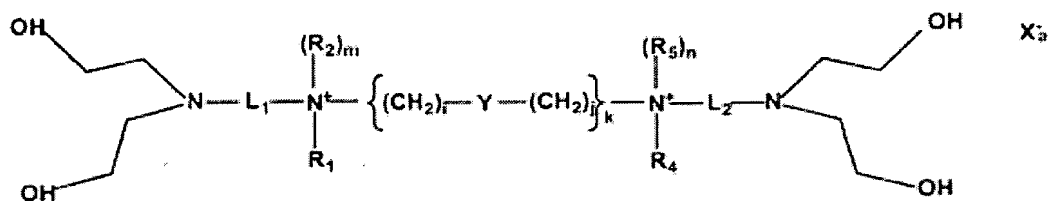
i and j are integers from about 2 to about 3;

k is an integer from 1 to about 3;

L₁ and L₂, independently from one another, are an alkylene or an alkylene ether; and

Y is selected from the group consisting of CH₂, O, S and NH.

56. The compound as claimed in claim 5, wherein said compound has the formula:



wherein

at least one of R_1 and R_4 is a straight chain or branched, cyclic, alkyl, alkenyl, alkynyl or aryl group having from about 8 to about 24 carbon atoms;

- 5 R_2 and R_5 , independently of one another, are selected from the group consisting of H and a $C_1 - C_8$ alkyl, alkenyl, aryl, and alkyl optionally substituted by one or more of an alcohol, an amine, an amide, an ether, a polyether, a polyamide, an ester, a mercaptan, a urea, a thiourea, a guanidyl, or a carbamoyl group;

m and n are 0 or 1;

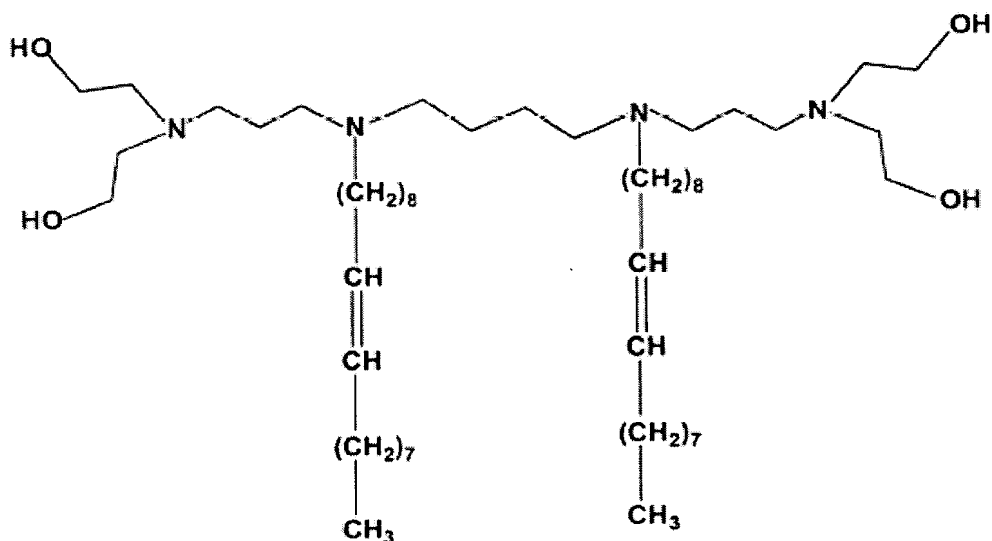
- 10 i and j are integers from about 2 to about 3;

k is an integer from 1 to about 3;

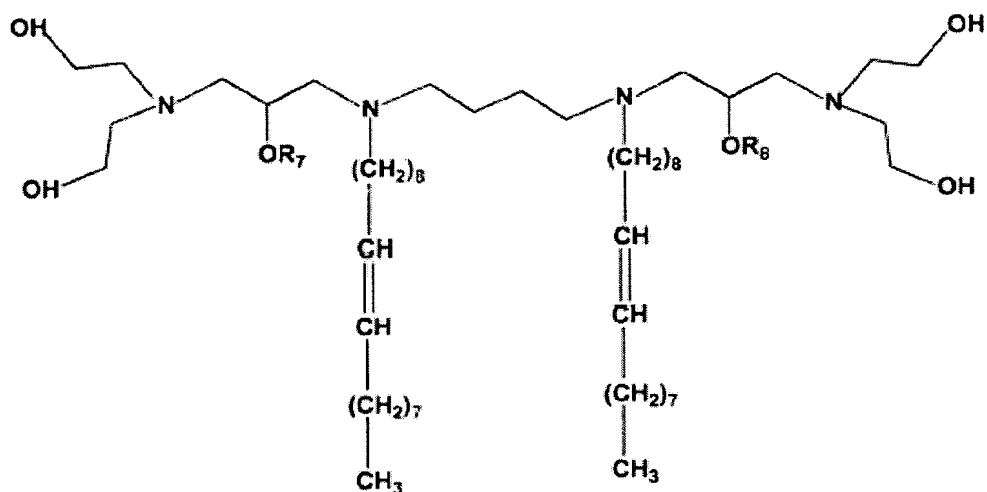
L_1 and L_2 independently from one another, are an alkylene or an alkylene ether; and

Y is selected from the group consisting of CH_2 , O, S and NH.

- 15 57. The compound as claimed in claim 56, which is:



58. The compound as claimed in 56, which is:

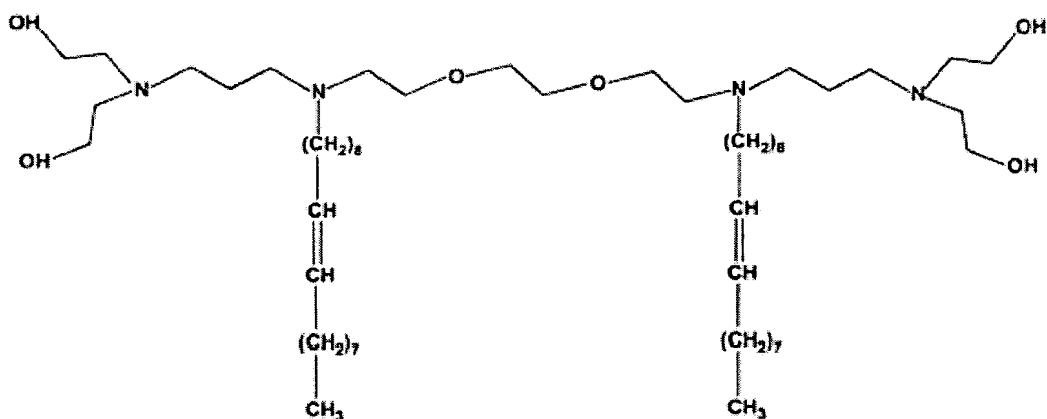


wherein R_7 and R_8 are independently H or a carbohydrate.

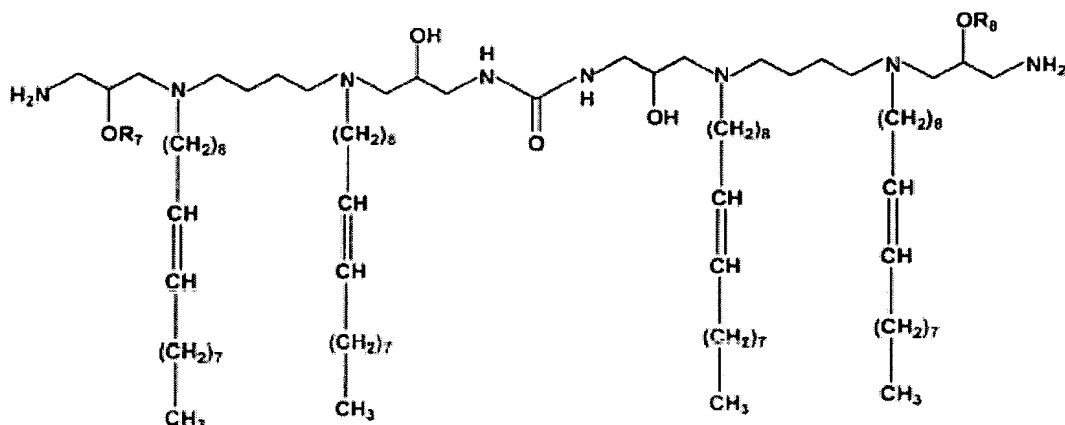
59. The compound as claimed in claim 58, wherein R_7 and R_8 are H.

5

60. The compound as claimed in 56, which is:



10 61. The compound as claimed in claim 5, which is:

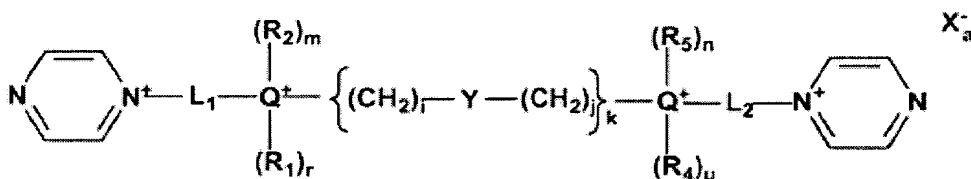


wherein R_7 and R_8 are independently H or a carbohydrate.

62. The compound as claimed in claim 61, wherein R_7 and R_8 are H.

5

63. The compound as claimed in claim 1, wherein said compound has the formula:



wherein

Q , R_1 , R_4 , r , u , m and n are as defined in claim 1;

10 R_2 and R_5 , independently of one another, are selected from the group consisting of H and a C_1 – C_8 alkyl, alkenyl, aryl, and alkyl optionally substituted by one or more of an alcohol, an amine, an amide, an ether, a polyether, a polyamide, an ester, a mercaptan, a urea, a thiourea, a guanidyl, or a carbamoyl group;

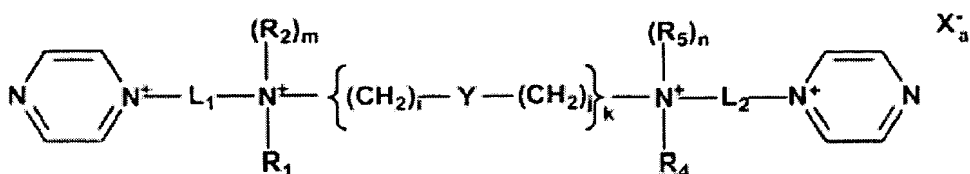
i and j are integers from about 2 to about 3;

15 k is an integer from 1 to about 3;

L_1 and L_2 , independently from one another, are an alkylene or an alkylene ether; and

Y is selected from the group consisting of CH_2 , O, S and NH.

64. The compound as claimed in claim 5, wherein said compound has the formula:



wherein

at least one of R_1 and R_4 is a straight chain or branched, cyclic, alkyl, alkenyl, alkynyl or aryl group having from about 8 to about 24 carbon atoms;

- 5 R_2 and R_5 , independently of one another, are selected from the group consisting of H and a $C_1 - C_8$ alkyl, alkenyl, aryl, and alkyl optionally substituted by one or more of an alcohol, an amine, an amide, an ether, a polyether, a polyamide, an ester, a mercaptan, a urea, a thiourea, a guanidyl, or a carbamoyl group;

m and n are 0 or 1;

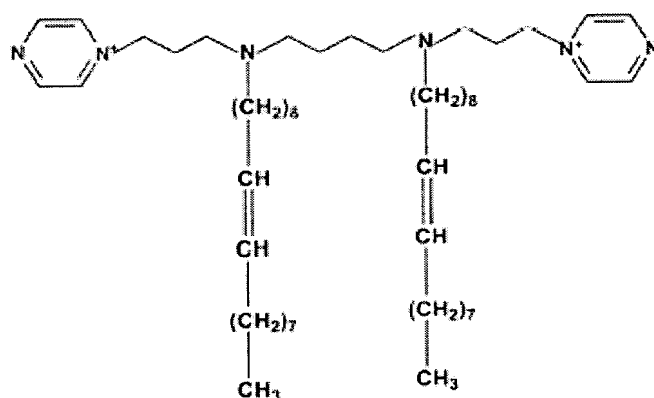
- 10 i and j are integers from about 2 to about 3;

k is an integer from 1 to about 3;

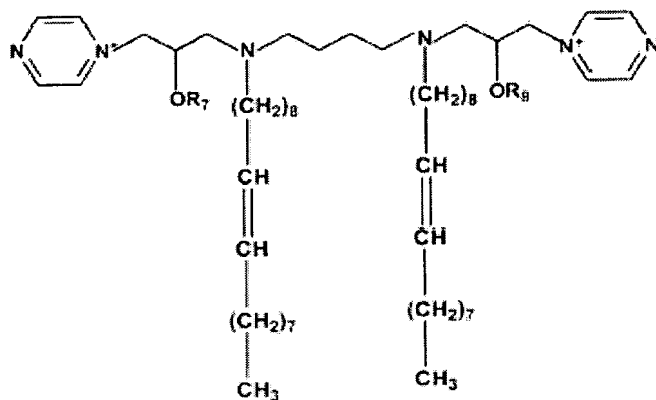
L_1 and L_2 , independently from one another, are an alkylene or an alkylene ether; and

Y is selected from the group consisting of CH_2 , O, S and NH.

- 15 65. The compound as claimed in claim 64, which is:



66. The compound as claimed in claim 64, which is:

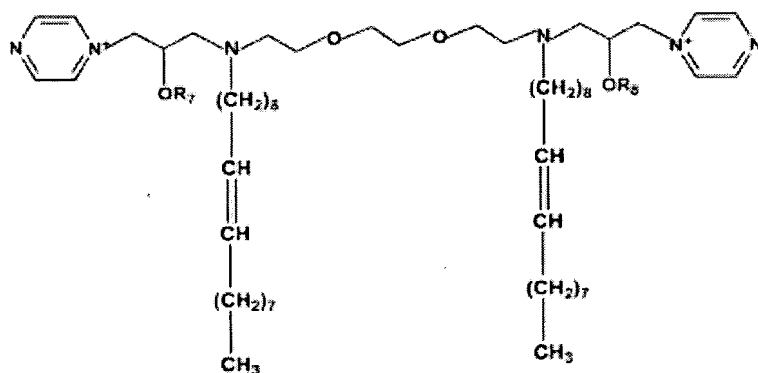


wherein R_7 and R_8 are independently H or a carbohydrate.

67. The compound as claimed in claim 66, wherein R_7 and R_8 are H.

5

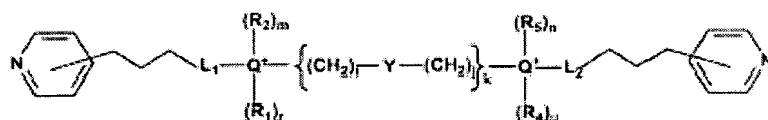
68. The compound as claimed in claim 64, which is:



wherein R_7 and R_8 are independently H or a carbohydrate.

10 69. The compound as claimed in claim 68, wherein R_7 and R_8 are H.

70. The compound as claimed in claim 1, wherein said compound has the formula:



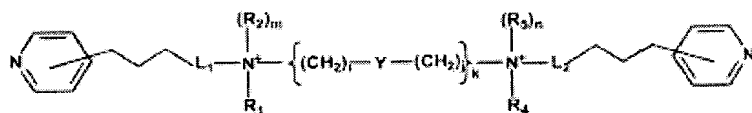
wherein

15 Q , R_1 , R_4 , r , u , m and n are as defined in claim 1;

R_2 and R_5 , independently of one another, are selected from the group consisting of H and a $C_1 - C_8$ alkyl, alkenyl, aryl, and alkyl optionally substituted by one or more of an alcohol, an amine, an amide, an ether, a polyether, a polyamide, an ester, a mercaptan, a urea, a thiourea, a guanidyl, or a carbamoyl group;

- 5 i and j are integers from about 2 to about 3;
 k is an integer from 1 to about 3;
 L_1 and L_2 , independently from one another, are an alkylene or an alkylene ether; and
 Y is selected from the group consisting of CH_2 , O, S and NH.

- 10 71. The compound as claimed in claim 5, wherein said compound has the formula:



wherein

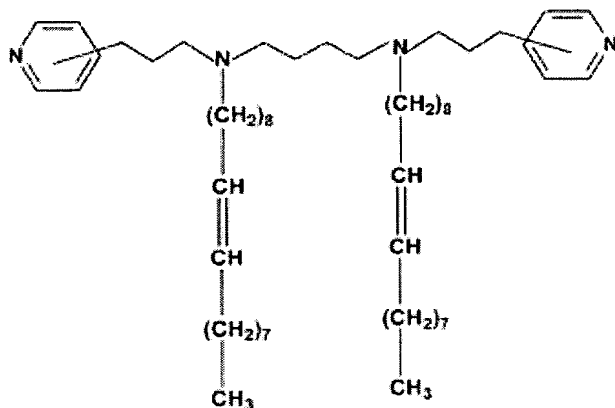
at least one of R_1 and R_4 is a straight chain or branched, cyclic, alkyl, alkenyl, alkynyl or aryl group having from about 8 to about 24 carbon atoms;

- 15 R_2 and R_5 , independently of one another, are selected from the group consisting of H and a $C_1 - C_8$ alkyl, alkenyl, aryl, and alkyl optionally substituted by one or more of an alcohol, an amine, an amide, an ether, a polyether, a polyamide, an ester, a mercaptan, a urea, a thiourea, a guanidyl, or a carbamoyl group;

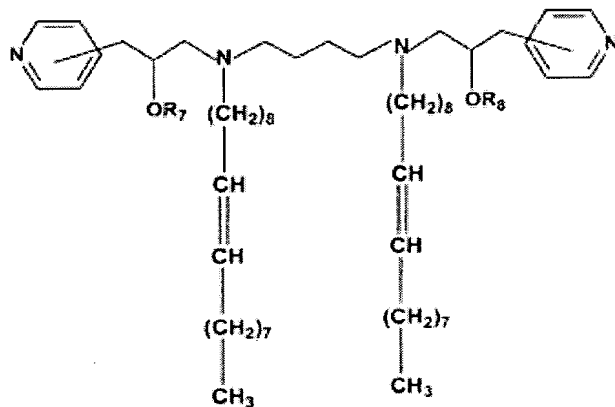
m and n are 0 or 1;

- 20 i and j are integers from about 2 to about 3;
 k is an integer from 1 to about 3;
 L_1 and L_2 independently from one another, are an alkylene or an alkylene ether; and
 Y is selected from the group consisting of CH_2 , O, S and NH.

- 25 72. The compound as claimed in claim 71, which is:



73. The compound as claimed in claim 71, which is:

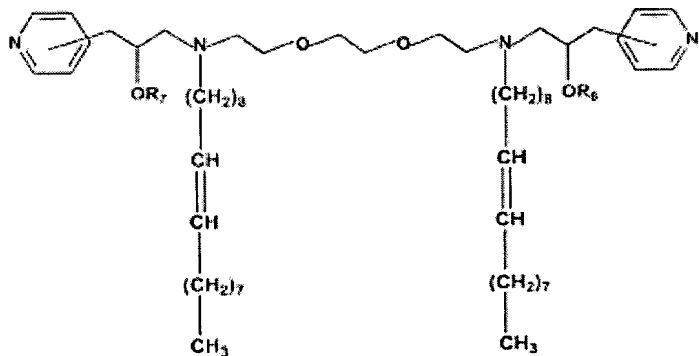


5

wherein R_7 and R_8 are independently H or a carbohydrate.

74. The compound according to claim 73, wherein R_7 and R_8 are H.

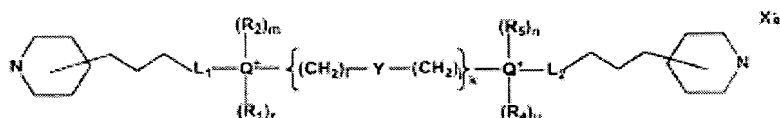
10 75. The compound as claimed in claim 71, which is:



wherein R₇ and R₈ independently are H or a carbohydrate.

76. The compound as claimed in claim 75, wherein R₇ and R₈ are H.

5 77. The compound as claimed in claim 1, wherein said compound has the formula:



wherein

Q, R₁, R₄, r, u, m, and n are as defined in claim 1;

10 R₂ and R₅, independently of one another, are selected from the group consisting of H and a C₁ – C₈ alkyl, alkenyl, aryl, and alkyl optionally substituted by one or more of an alcohol, an amine, an amide, an ether, a polyether, a polyamide, an ester, a mercaptan, a urea, a thiourea, a guanidyl, or a carbamoyl group;

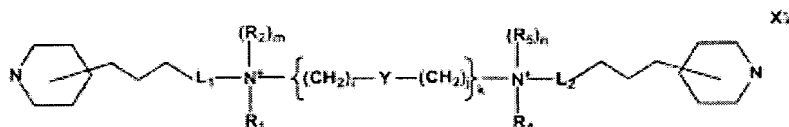
i and j are integers from about 2 to about 3;

k is an integer from 1 to about 3;

15 L₁ and L₂, independently from one another, are an alkylene or an alkylene ether; and

Y is selected from the group consisting of CH₂, O, S and NH.

78. The compound as claimed in claim 5, wherein said compound has the formula:



20 wherein

at least one of R₁ and R₄ is a straight chain or branched, cyclic, alkyl, alkenyl, alkynyl or aryl group having from about 8 to about 24 carbon atoms;

25 R₂ and R₅ independently of one another, are selected from the group consisting of H and a C₁ – C₈ alkyl, alkenyl, aryl, and alkyl optionally substituted by one or more of an alcohol, an amine, an amide, an ether, a polyether, a polyamide, an ester, a mercaptan, a urea, a thiourea, a guanidyl, or a carbamoyl group;

m and n are 0 or 1;

i and j are integers from about 2 to about 3;

k is an integer from 1 to about 3;

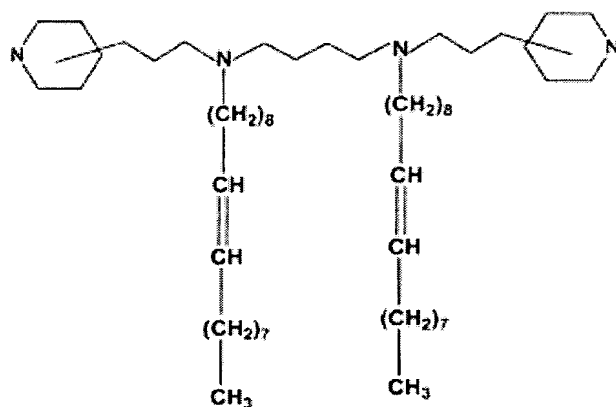
L₁ and L₂, independently from one another, are an alkylene or an alkylene ether;

and

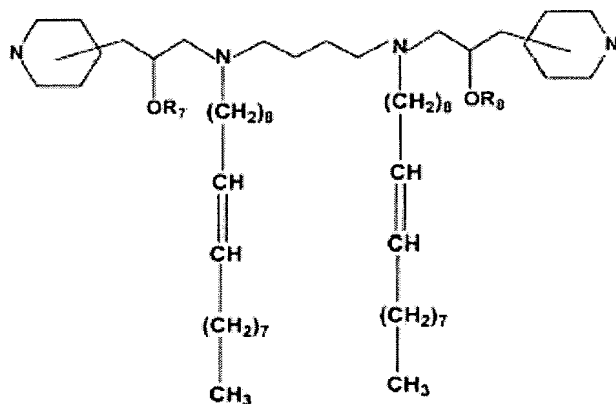
Y is selected from the group consisting of CH₂, O, S and NH.

5

79. The compound as claimed in claim 78, which is:



10 80. The compound as claimed in claim 78, which is:

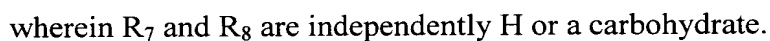


wherein R₇ and R₈ are independently H or a carbohydrate.

81. The compound as claimed in claim 80, wherein R₇ and R₈ are H.

15

82. The compound as claimed in claim 78, which is:



- 5

-
- The chemical structure shows a symmetrical molecule with two phenyl rings and two hydroxyl groups. The central part consists of two $(CH_2)_8$ chains connected by a $CH=CH$ double bond. Each $(CH_2)_8$ chain is further connected to a $CH=CH$ double bond, which is then connected to a $(CH_2)_7$ chain, and finally to a CH_3 group. The phenyl rings are attached to the $CH=CH$ double bonds via a CH_2 group. The hydroxyl groups are attached to the CH_2 groups adjacent to the $CH=CH$ double bonds.

- $$\begin{array}{c} \text{O} - (\text{CH}_2)_m - \text{O} \\ \diagup \quad \quad \diagdown \\ (\text{CH}_2)_n \quad \quad (\text{CH}_2)_n \\ | \quad \quad \quad | \\ \text{R}_3 - \text{N}^+ - \left\{ (\text{CH}_2)_l - \text{Y} - (\text{CH}_2)_j \right\}_k - \text{N}^+ - \text{R}_6 \\ | \quad \quad \quad | \\ \text{R}_5 \quad \quad \quad \text{R}_4 \end{array} \quad \text{X}^a$$

10

Y is selected from the group consisting of CH₂, an ether, a polyether, an amide, a polyamide, an ester, a sulfide, a urea, a thiourea, a guanidyl, a carbamoyl, a carbonate, a

phosphate, a sulfate, a sulfoxide, an imine, a carbonyl, and a secondary amino group and wherein Y is optionally substituted by $-X_1-L'-X_2-Z$ or $-Z$;

R_1 , R_3 , R_4 and R_6 , independently of one another, are selected from the group consisting of H, $-(CH_2)_p-D-Z$, an alkyl, an alkenyl, an aryl, and an alkyl or an alkyl ether optionally substituted by one or more of an alcohol, an aminoalcohol, an amine, an amide, an ether, a polyether, a polyamide, an ester, a mercaptan, an alkylthio, a urea, a thiourea, a guanidyl, or a carbamoyl group, and at least one of R_1 , R_3 , R_4 and R_6 is a straight chain or branched, cyclic, alkyl, alkenyl, alkynyl or aryl group having from 6 to about 64 carbon atoms; and R_1 , R_3 , R_4 and R_6 may optionally be covalently linked with each other or with Y, to form a cyclic moiety;

Z is selected from the group consisting of amine, spermiyl, carboxyspermiyl, guanidyl, spermidinyl, putricinyl, diaminoalkyl, pyridyl, piperidinyl, pyrrolidinyl, polyamine, amino acid, peptide, and protein;

X_1 and X_2 independently of one another, are selected from the group consisting of NH, O, S, alkylene, and arylene;

L' is selected from the group consisting of alkylene, alkenylene, alkynylene, arylene, alkylene ether, and polyether;

D is Q or a bond;

m and n are 0 or 1; and

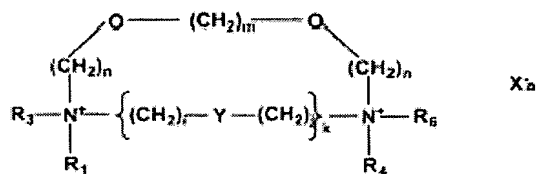
i, j, k, l and p are integers from 1 to about 10.

86. The compound as claimed in claim 85, wherein at least one of R_1 and R_4 is a straight chain or branched, cyclic, alkyl, alkenyl, alkynyl or aryl group having from about 8 to about 24 carbon atoms.

87. The compound as claimed in claim 85, wherein the alkyl ether optionally substituted by one or more alcohol groups is a carbohydrate.

88. The compound as claimed in claim 87, wherein the carbohydrate is selected from the group consisting of galactose, fructose, glucose, maltose, sucrose, cellobiose, lactose, mannose, glucopyranose, mannopyranose and galactopyranose.

89. The compound as claimed in claim 85, wherein said compound has the formula:



wherein

Y is selected from the group consisting of CH₂, an ether, a polyether, an amide, a polyamide, an ester, a sulfide, a urea, a thiourea, a guanidyl, a carbamoyl, a carbonate, and a secondary amino group;

R₁, R₃, R₄ and R₆, independently of one another, are selected from the group consisting of H, $-(\text{CH}_2)_p\text{-Z}$, an alkyl, an alkenyl, an aryl, and an alkyl or an alkyl ether optionally substituted by one or more of an alcohol, an aminoalcohol, an amine, an amide, an ether, a polyether, a polyamide, an ester, a mercaptan, a urea, a thiourea, a guanidyl, or a carbamoyl group, and at least one of R₁, R₃, R₄ and R₆ is a straight chain or branched, cyclic, alkyl, alkenyl, alkynyl or aryl group having from about 6 to about 64 carbon atoms; and R₁, R₃, R₄ and R₆ may optionally be covalently linked with each other, to form a cyclic moiety;

Z is selected from the group consisting of amine, spermyl, carboxyspermyl, guanidyl, spermidinyl, putricinyl, diaminoalkyl, pyridyl, piperidinyl, pyrrolidinyl, polyamine, amino acid, peptide, and protein;

m and n are 0 or 1; and

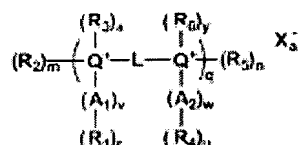
i, j, k, l and p are integers from 1 to about 10.

90. The compound as claimed in claim 89, wherein at least one of R₁ and R₄ is a straight chain or branched, cyclic, alkyl, alkenyl, alkynyl or aryl group having from about 8 to about 24 carbon atoms.

91. The compound as claimed in claim 89, wherein the alkyl ether optionally substituted by one or more alcohol groups is a carbohydrate.

92. The compound as claimed in claim 91, wherein the carbohydrate is selected from the group consisting of galactose, fructose, glucose, maltose, sucrose, cellobiose, lactose, mannose, glucopyranose, mannopyranose and galactopyranose.

93. A compound having the formula:



wherein

Q is selected from the group consisting of N, O and S;

L is a bivalent organic radical capable of covalently linking each Q;

- 5 $R_1 - R_6$ independently of one another, are selected from the group consisting of H, $-(CH_2)_p-D-Z$, an alkyl, an alkenyl, an aryl, and an alkyl or alkyl ether optionally substituted by one or more of an alcohol, an aminoalcohol, an amine, an amide, an ether, a polyether, a polyamide, an ester, a mercaptan, an alkylthio, a urea, a thiourea, a guanidyl, or a carbamoyl group, and wherein at least one of R_1 , R_3 , R_4 and R_6 is a straight chain or
- 10 branched, cyclic, alkyl, alkenyl, alkynyl or aryl group having from about 6 to about 64 carbon atoms; and R_1 and R_4 or R_3 and R_6 may optionally be covalently linked with each other, or with L to form a cyclic moiety;

Z is selected from the group consisting of amine, spermiyl, carboxyspermiyl, guanidyl, spermidinyl, putricinyl, diaminoalkyl, pyridyl, piperidinyl, pyrrolidinyl, polyamine,

15 amino acid, peptide, and protein;

D is Q or a bond;

A_1 and A_2 , independently of one another, are selected from the group consisting of CH_2O , CH_2S , CH_2NH , $C(O)$, $C(NH)$, $C(S)$ and $(CH_2)_t$;

- 20 X is a physiologically acceptable anion; m, n, r, s, u, v, w and y are 0 or 1, with the proviso that when both m and n are 0 at least one of r, s, u and y is other than 0;

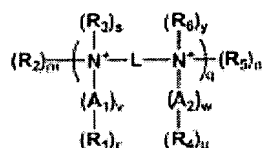
i, j, k, l, p and t are integers from 0 to about 100;

q is an integer from 1 to about 1000; and

a is the number of positive charge divided by the valence of the anion.

- 25 94. The compound as claimed in any one of claims 1, 5, 85, 89 and 93, wherein said cyclic group is a cholesteryl group.

95. A compound or a polycation having the formula:



wherein

L is C, CH, (CH₂)_l or {(CH₂)_i - Y - (CH₂)_j}_k, wherein Y is selected from the group consisting of CH₂, an ether, a polyether, an amide, a polyamide, an ester, a sulfide, a urea, a thiourea, a guanidyl, a carbamoyl, a carbonate, a phosphate, a sulfate, a sulfoxide, an imine, a carbonyl, and a secondary amino group and wherein Y is optionally substituted by - X₁- L' - X₂- Z or - Z;

R₁ - R₆, independently of one another, are selected from the group consisting of H, - (CH₂)_p- D-Z, an alkyl, an alkenyl, an aryl, and an alkyl or an alkyl ether optionally substituted by one or more of an alcohol, an aminoalcohol, an amine, an amide, an ether, a polyether, a polyamide, an ester, a mercaptan, an alkylthio, a urea, a thiourea, a guanidyl, or a carbamoyl group, and wherein at least one of R₁, R₃, R₄ and R₆ is a straight chain or branched, cyclic, alkyl, alkenyl, alkynyl or aryl group having from about 6 to about 64 carbon atoms;

Z is selected from the group consisting of amine, spermiyl, carboxyspermiyl, guanidyl, spermidinyl, putricinyl, diaminoalkyl, pyridyl, piperidinyl, pyrrolidinyl, polyamine, amino acid, amino acid derivative, peptide, and protein;

X₁ and X₂ independently of one another, are selected from the group consisting of NH, O, S, alkylene and arylene;

L' is selected from the group consisting of alkylene, alkenylene, alkynylene, arylene, alkylene ether, and polyether;

A₁ and A₂ independently of one another, are selected from the group consisting of CH₂O, CH₂S, CH₂NH, C(O), C(NH), C(S) and (CH₂)_t;

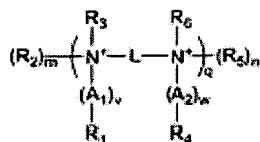
m, n, r, s, u, v, w and y are 0 or 1, with the proviso that when both m and n are 0 at least one of r, s, u and y is other than 0;

i, j, k, l, p and t are integers from 0 to about 100; and

q is an integer from 1 to about 1000.

The compound or the polycation as claimed in claim 95, wherein at least one of R₁, R₃, R₄ and R₆ is a straight chain or branched, cyclic, alkyl, alkenyl, alkynyl or aryl group having from about 8 to about 24 carbon atoms.

97. A compound or a polycation having the formula:



wherein

- 5 L is $(\text{CH}_2)_1$ or $\{(\text{CH}_2)_i - \text{Y} - (\text{CH}_2)_j\}_k$, wherein Y is selected from the group consisting of CH_2 , an ether, a polyether, an amide, a polyamide, an ester, a sulfide, a urea, a thiourea, a guanidyl, a carbamoyl, a carbonate, and a secondary amino group;
- R₁ – R₆, independently of one another, are selected from the group consisting of H, $-(\text{CH}_2)_p\text{-Z}$, an alkyl, an alkenyl, an aryl, and an alkyl or an alkyl ether optionally
- 10 substituted by one or more of an alcohol, an aminoalcohol, an amine, an amide, an ether, a polyether, a polyamide, an ester, a mercaptan, a urea, a thiourea, a guanidyl, or a carbamoyl group, and at least one of R₁, R₃, R₄ and R₆ is a straight chain or branched, cyclic, alkyl, alkenyl, alkynyl or aryl group having from about 6 to about 64 carbon atoms;
- Z is selected from the group consisting of amine, spermiyl, carboxyspermiyl,
- 15 guanidyl, spermidinyl, putricinyl, diaminoalkyl, pyridyl, piperidinyl, pyrrolidinyl, polyamine, amino acid, amino acid derivative, peptide, and protein;
- A₁ and A₂, independently of one another, are selected from the group consisting of CH_2O , CH_2S , CH_2NH , $\text{C}(\text{O})$, $\text{C}(\text{NH})$, $\text{C}(\text{S})$ and $(\text{CH}_2)_t$;
- m, n, v and w are 0 or 1;
- 20 i, j, k, l, p and t are integers from 1 to about 100; and
- q is an integer from 1 to about 1000.

98. The compound or the polycation as claimed in claim 97, wherein at least one of R₁, R₃, R₄ and R₆ is a straight chain or branched, cyclic, alkyl, alkenyl, alkynyl or aryl group
- 25 having from about 8 to about 24 carbon atoms.

99. The compound or the polycation as claimed in claim 95 or 97, wherein the alkyl ether optionally substituted by one or more alcohol groups is a carbohydrate.

100. The compound or the polycation as claimed in claim 99, wherein the carbohydrate is selected from the group consisting of galactose, fructose, glucose, maltose, sucrose, cellobiose, lactose, mannose, glucopyranose, mannopyranose and galactopyranose.

5 101. A composition comprising one or more compounds of any one of claims 1, 37, 38, 85, 93, 95 and 97.

102. A composition comprising one or more compounds of any one of claims 1, 37, 38, 85, 93, 95 and 97 and at least one additional component selected from the group consisting of a
10 cell, cells, a cell culture, a cell culture media, a neutral lipid, a nucleic acid, and a transfection enhancer.

103. The composition of claim 102, which comprises a nucleic acid.

15 104. A lipid aggregate comprising one or more compounds of any one of claims 1, 37, 38, 85, 93, 95 and 97.

105. The lipid aggregate of claim 104, which comprises at least one lipid aggregate-forming compound.

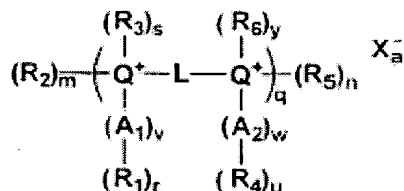
20 106. The lipid aggregate of claim 105, wherein said lipid aggregate-forming compound is selected from the group consisting of DOPE, DOPC and cholesterol.

107. A kit comprising one or more compounds of any one of claims 1, 37, 38, 85, 93, 95
25 and 97 and at least one additional component selected from the group consisting of a cell, cells, a cell culture media, a nucleic acid, a transfection enhancer and instructions for transfecting a cell or cells.

108. A method for introducing a polyanion into a cell or cells, said method comprising
30 forming a liposome from a positively charged compound of any one or claims 1, 37, 38, 85, 93, 95 and 97, contacting the liposome with a polyanion to form a positively-charged polyanion- liposome complex and incubating the complex with a cell or cells.

109. A method for introducing a biologically active substance into a cell, said method comprising forming a liposome of a compound of any one of claims 1, 37, 38, 85, 93, 95 and 97 and a biologically active substance and incubating the liposome with a cell or cell culture.

5 110. A compound having the formula:



wherein

Q is selected from the group consisting of 0 and S;

10 L is C, CH or $\{(CH_2)_i-Y-(CH_2)_j\}_k$, wherein Y is selected from the group consisting of an ether, a polyether, an amide, a polyamide, an ester, a sulfide, a urea, a thiourea, a guanidyl, a carbamoyl, a carbonate, a phosphate, a sulfate, a sulfoxide, an imine, a carbonyl, and a secondary amino group and wherein Y is optionally substituted by $-X_1-L'-X_2-Z$ or $-Z$;

15 R_1-R_6 , independently of one another, are selected from the group consisting of H, $-(CH_2)_p-D-Z$, an alkyl, an alkenyl, an aryl, and alkyl ether, wherein any one of R_1-R_6 are optionally substituted by one or more of an alcohol, an aminoalcohol, an amine, an amide, an ether, a polyether, a polyamide, an ester, a mercaptan, an alkylthio, a urea, a thiourea, a guanidyl, or a carbamoyl group, and wherein at least one of R_1 , R_3 , R_4 and R_6 is a straight chain or branched, cyclic, alkyl, alkenyl, alkynyl or aryl group having from about 6 to about 64 carbon atoms; and R_1 and R_4 or R_3 and R_6 may optionally be covalently linked with each
20 other, with Y or with L when L is C or CH to form a cyclic moiety;

Z is selected from the group consisting of amine, spermyl, carboxyspermyl, guanidyl, spermidinyl, putricinyl, diaminoalkyl, pyridyl, piperidinyl, pyrrolidinyl, polyamine, amino acid, peptide, and protein;

25 X_1 and X_2 , independently of one another, are selected from the group consisting of NH, 0, S, alkylene, and arylene;

L' is selected from the group consisting of alkyl, alkenylene, alkynylene, arylene, alkylene ether, and polyether;

D is Q or a bond;

30 A_1 and A_2 , independently of one another, are selected from the group consisting of CH_2O , CH_2S , CH_2NH , $C(O)$, $C(NH)$, $C(S)$ and $(CH_2)_t$;

X is a physiologically acceptable anion;

m, n, r, s, u, v, w and y are 0 or 1, with the proviso that when both m and n are 0 at least one of r, s, u and y is other than 0;

i, j, k, l, p and t are integers from 0 to about 100;

5 q is an integer from to about 1000; and

a is the number of positive charge divided by the valence of the anion.

111. The compound as claimed in claim 93, which is:

- 10 N^1, N^4 -dipalmitoyl- N^1, N^4 -di-[2-hydroxy-3-(N-aminopropyl)]-diaminobutane;
 N^1, N^4 -distearyl- N^1, N^4 -di-[2-hydroxy-3-(N-aminopropyl)]-diaminobutane;
 N^1, N^4 -dilauryl- N^1, N^4 -di-[2-hydroxy-3-(N-aminopropyl)]-diaminobutane;
 N^1, N^2 -dimyristyl- N^1, N^2 -di-[2-hydroxy-3-(N-aminopropyl)]-diaminoethane;
 N^1, N^2 -dipalmityl- N^1, N^2 -di-[2-hydroxy-3-(N-aminopropyl)]-diaminoethane;
15 N^1, N^2 -dipalmitoyl- N^1, N^2 -di-[2-hydroxy-3-(N-aminopropyl)]-diaminoethane;
 N^1, N^2 -distearyl- N^1, N^2 -di-[2-hydroxy-3-(N-aminopropyl)]-diaminoethane;
 N^1, N^2 -dilauryl- N^1, N^2 -di-[2-hydroxy-3-(N-aminopropyl)]-diaminoethane;
 N^1, N^8 -dimyristyl- N^1, N^8 -di-[2-hydroxy-3-(N-aminopropyl)]-Jeffamine;
 N^1, N^8 -dipalmityl- N^1, N^8 -di-[2-hydroxy-3-(N-aminopropyl)]-Jeffamine;
20 N^1, N^8 -dipalmitoyl- N^1, N^8 -di-[2-hydroxy-3-(N-aminopropyl)]-Jeffamine;
 N^1, N^8 -distearyl- N^1, N^8 -di-[2-hydroxy-3-(N-aminopropyl)]-Jeffamine;
 N^1, N^8 -dilauryl- N^1, N^8 -di-[2-hydroxy-3-(N-aminopropyl)]-Jeffamine;
 N^1, N^8 -dioleoyl- N^1, N^8 -di-[2-hydroxy-3-(N-aminopropyl)]-Jeffamine;
 N^1, N^4 -dimyristyl- N^1, N^4 -di-[2-hydroxy-3-(N-spermincarboxamido)-aminopropyl]-
diaminobutane;
25 N^1, N^4 -dipalmityl- N^1, N^4 -di-[2-hydroxy-3-(N-spermincarboxamido)-aminopropyl]-
diaminobutane;
 N^1, N^4 -dipalmitoyl- N^1, N^4 -di-[2-hydroxy-3-(N-spermincarboxamido)-aminopropyl]-
diaminobutane;
30 N^1, N^4 -distearyl- N^1, N^4 -di-[2-hydroxy-3-(N-spermincarboxamido)-aminopropyl]-
diaminobutane;
 N^1, N^4 -dilauryl- N^1, N^4 -di-[2-hydroxy-3-(N-spermincarboxamido)-aminopropyl]-
diaminobutane;
 N^1, N^8 -dimyristyl- N^1, N^8 -di-[2-hydroxy-3-(N-spermincarboxamido)-aminopropyl]-
Jeffamine;

N^1, N^8 -dipalmityl- N^1, N^8 -di-[2-hydroxy-3-(N-sperminecarboxamido)-aminopropyl]-
Jeffamine;

N^1, N^8 -dipalmitolyl- N^1, N^8 -di-[2-hydroxy-3-(N-sperminecarboxamido)-aminopropyl]-
Jeffamine;

5 N^1, N^8 -distearyl- N^1, N^8 -di-[2-hydroxy-3-(N-sperminecarboxamido)-aminopropyl]-
Jeffamine;

N^1, N^8 -dilauryl- N^1, N^8 -di-[2-hydroxy-3-(N-sperminecarboxamido)-aminopropyl]-
Jeffamine;

10 N^1, N^8 -dioleyl- N^1, N^8 -di-[2-hydroxy-3-(N-sperminecarboxamido)-aminopropyl]-
Jeffamine;

N^1, N^2 -dimyristyl- N^1, N^2 -di-[2-hydroxy-3-(N-sperminecarboxamido)-aminopropyl]-
diaminoethane;

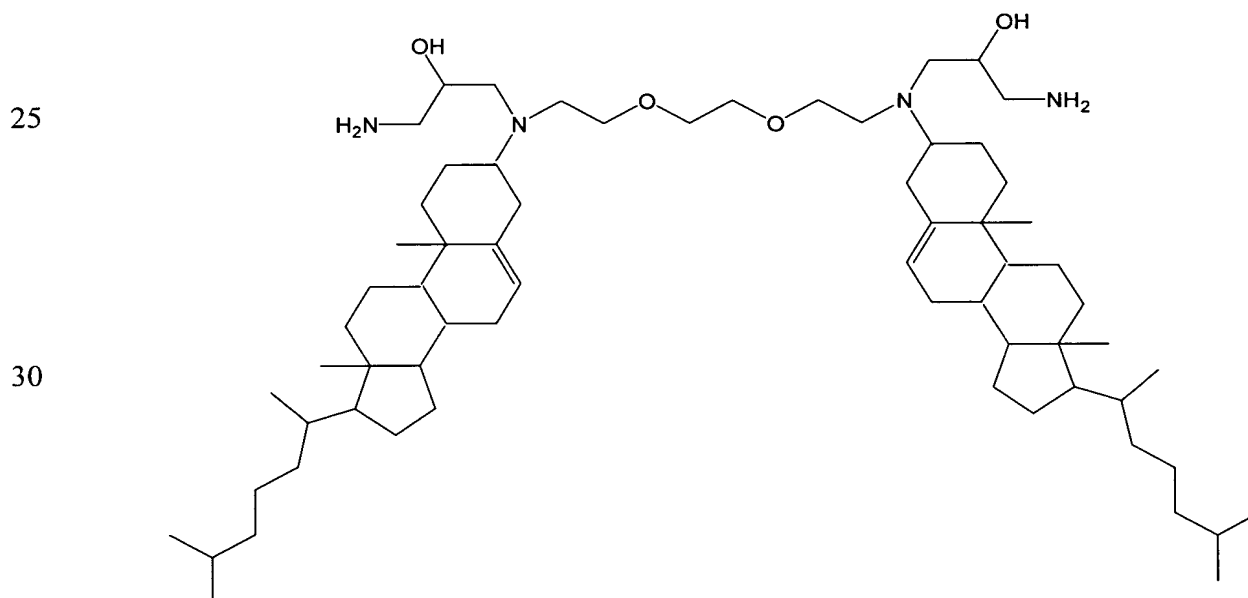
N^1, N^2 -dipalmityl- N^1, N^2 -di-[2-hydroxy-3-(N-sperminecarboxamido)-aminopropyl]-
diaminoethane;

15 N^1, N^2 -dipalmitolyl- N^1, N^2 -di-[2-hydroxy-3-(N-sperminecarboxamido)-aminopropyl]-
diaminoethane;

N^1, N^2 -distearyl- N^1, N^2 -di-[2-hydroxy-3-(N-sperminecarboxamido)-aminopropyl]-
diaminoethane; or

20 N^1, N^2 -dilauryl- N^1, N^2 -di-[2-hydroxy-3-(N-sperminecarboxamido)-aminopropyl]-
diaminoethane.

112. The compound as claimed in claim 93, which is:



113. The compound as claimed in claim 5, wherein Z is selected from the group consisting of spermiyl, spermidiyl, amino acid, peptidyl, diaminoalkyl, and polyamine when Z is part of any of the groups $-(CH_2)_bNHC(O)Z$, $-(CH_2)_cNHC(O)Z$, $-CH_2CH(OR_7)CH_2NHC(O)Z$, or $-CH_2CH(OR_8)CH_2NHC(O)Z$.

114. The compound as claimed in claim 93, wherein Z is selected from the group consisting of spermiyl, spermidiyl, amino acid, peptidyl, diaminoalkyl, and polyamine when Z is part of any of the groups $-(CH_2)_bNHC(O)Z$, $-(CH_2)_cNHC(O)Z$, $-CH_2CH(OR_7)CH_2NHC(O)Z$, or $-CH_2CH(OR_8)CH_2NHC(O)Z$.

115. The compound or the polycation as claimed in claim 95, wherein Z is selected from the group consisting of spermiyl, spermidiyl, amino acid, peptidyl, diaminoalkyl, and polyamine when Z is part of any of the groups $-(CH_2)_bNHC(O)Z$, $-(CH_2)_cNHC(O)Z$, $-CH_2CH(OR_7)CH_2NHC(O)Z$, or $-CH_2CH(OR_8)CH_2NHC(O)Z$.

116. The compound or the polycation as claimed in claim 97, wherein Z is selected from the group consisting of spermiyl, spermidiyl, amino acid, peptidyl, diaminoalkyl, and polyamine when Z is part of any of the groups $-(CH_2)_bNHC(O)Z$, $-(CH_2)_cNHC(O)Z$, $-CH_2CH(OR_7)CH_2NHC(O)Z$, or $-CH_2CH(OR_8)CH_2NHC(O)Z$.